

GEOL 601/GGS 657: *The Lithosphere*

Overview of Earth's interior and lithosphere, structure and composition; plate tectonics and geodynamics; observation, analysis and modeling. 3 credits.

BASIC INFORMATION:

Instructor: Linda Hinnov, Dept. AOES, email: lhinnov@gmu.edu

Class Meetings: Tuesdays, Thursdays, 10.30-11.45, Exploratory 1005.

Materials: Online resources, review and research books and articles (see Blackboard.)

Requirements: 8 assignments

Ethics: See <https://oai.gmu.edu/mason-honor-code/full-honor-code-document/>.

CLASS SCHEDULE:

WEEK 1: Earth's interior: crust to core overview

Aug 27 – Lecture 1a – Early discoveries

Aug 29 – Lecture 1b – Rheology and (P)REM models

Assignment 1; due Sep 05

WEEK 2: Observing Earth's interior I

Sep 03 – Lecture 2a – Gravity

Sep 05 – Lecture 2b – Heat flow

Assignment 2: due Sep 12

WEEK 3: Observing Earth's interior II

Sep 10 – Lecture 3a – Geomagnetism

Sep 12 – Lecture 3b – Seismology

Assignment 3: due Sep 19

WEEK 4: Earth's upper lithosphere ("crustal lithosphere")

Sep 17 – Lecture 4a – Oceanic crust

Sep 19 – Lecture 4b – Continental crust

Assignment 4: due Sep 26

WEEK 5: Earth's lower lithosphere ("mantle lithosphere")

Sep 24 – Lecture 5a – Oceanic vs. continental mantle lithosphere

Sep 26 – Lecture 5b – The lithosphere/asthenosphere boundary

Assignment 5: due Oct 03

WEEK 6: Lithospheric dynamics I

Oct 01 – Lecture 6a – Seafloor spreading: evidence; fracture zones (*Zoom only*)

Oct 03 – Lecture 6b – Seafloor spreading: driving forces

Assignment 6: due Oct 10

WEEK 7: Lithospheric dynamics II

Oct 08 – Lecture 7a – Continental drift: paleomagnetism

Oct 10 – Lecture 7b – Continental drift: polar wander

Assignment 7: due Oct 17

WEEK 8: Plate tectonics

Oct 15 – Lecture 8a – Tectonic plates and driving forces
Oct 17 – Lecture 8b – Measuring plate motion; Euler poles
Assignment 8: due Oct 24

WEEK 9: Divergent plate boundaries

Oct 22 – Lecture 9a – Breakup unconformities, mid-ocean ridges
Oct 24 – Lecture 9b – Rift, drift and passive margins; aulacogens

WEEK 10: Convergent plate boundaries

Oct 29 – Lecture 10a – Active margins
Oct 31 – Lecture 10b – Island arcs and orogenies

WEEK 11: Hotspots and LIPs

Nov 05 – Lecture 11a – Space-time occurrence and origins
Nov 07 – Lecture 11b – Earth system consequences

WEEK 12: Dynamic topography

Nov 12 – Lecture 12a – Earth surface topography and isostasy
Nov 14 – Lecture 12b – Non-isostatic topography

WEEK 13: Mantle convection

Nov 19– Lecture 13a –Evidence for mantle convection
Nov 21– Lecture 13b – Mantle convection models

WEEK 14: Supercontinental cycles

Nov 26– Lecture 14a – Pangaea assembly/breakup
Nov 28– NO CLASS

WEEK 15: Onset of plate tectonics

Dec 03– Lecture 15a – Proterozoic supercontinents
Dec 05– Lecture 15b – Archean supercontinents

LEARNING OBJECTIVES:

Knowledge and Understanding

- Gain knowledge about the structure, composition and dynamics of the Earth's lithosphere.
- Gain knowledge about methods used to model the Earth's lithosphere.
- Understand the geological evolution of the Earth's lithosphere.

Analytical Skills and Abilities

- Develop ability to access reliable information about lithospheric geology and geophysics.
- Develop skills for solving quantitative problems in lithospheric geology and geophysics.

Professional Development

- Communicate effectively about the structure, composition and dynamics of the Earth's lithosphere and deep interior.
- Learn how to stay informed about ongoing/new discoveries and methods in lithospheric geology and geophysics.

ADDITIONAL INFORMATION:

Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit <https://ds.gmu.edu/> for detailed information about the Disability Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu | Phone: (703) 993-2474.